WEIGHT MEMBER FOR A GOLF CLUB HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a weight member. In particular, the present invention relates to a weight member for a golf club head.

2. Description of Related Art

A conventional weight member for a golf club head is made by powder metallurgy in which metal powders of high density and high rigidity such as tungsten having a density of 19.30g/cm^3, iron having a density of 7.8g/cm^3, and nickel having a density of 8.9g/cm^3 are pressed and formed and then sintered to form a WFeNi alloy that forms the weight member for a golf club head. Although the powder metallurgy is widely used, several disadvantages exist, including high cost for molds, low stretchability of products, long processing time, aptness to thermal expansion/shrinkage, and difficulty in forming delicate patterns, letters, serial number, trade names, etc.

Another method for manufacturing a weight member made of WFeNi alloy includes a precision casting process in which a specific metal melting sequence and a specific composition ratio are utilized to prevent sedimentation of tungsten having a high melting point. In the precision casting process, nickel of 30%-50%, iron of 30%-50%, tungsten of 20%-35%,

silicon of less than 1%, manganese of less than 1%, and niobium of less than 0.5% are fed into a high-temperature furnace at a temperature above 1450℃ and melt to form a weight member made of WFeNi alloy for a golf club head. The weight member is then inserted or welded to a golf club head body that is generally made of stainless steel of SUS304, 17-4, and 4130.

This precision casting process overcomes the problems of the above conventional powder metallurgy. However, if the mixture ratio of the nickel, iron, and tungsten was not properly controlled, a pearlite structure was precipitated in a base of a γ (iron, nickel) phase of the WFeNi alloy, deteriorating the rust-resisting property of the weight member. Further, cracks were apt to be generated while welding the weight member to the golf club head body. During spray testing at 40℃ for 24 hours (which simulates a highly corrosive environment) to the WFeNi alloy by using NaCl solution of 5% by weight, the rusted area of the WFeNi alloy often exceeded 8% of the overall surface area of the WFeNi alloy. Further, since tungsten was often precipitated on the surface of the WFeNi alloy (the deep color portion is the pearlite structure and the white portion surrounded by the pearlite structure is the precipitated tungsten), the tungsten/γ (iron, nickel) phase formed by the alloy caused patterns on the weight member made of WFeNi alloy after grinding and polishing procedures. As a result, an obvious insertion line was

generated when the weight member made of WFeNi alloy was directly inserted into a bottom surface of a golf club head body. Further, the insertion line of the products varied in response to the thickness ground off and the grinding angle. Thus, it is difficult to control the processing conditions.

In conclusion, since the conventional weight member made of WFeNi alloy contains iron such that the weight member has poor characteristics in the metallographical composition, rust-resisting property, and welding. The assembling procedure, appearance, bonding strength, manufacturing tolerance, and life of the golf club product are adversely affected.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a weight member for a golf club head, wherein molybdenum is added to increase the density of the weight member and to improve the rust-resisting property of the weight member.

Another object of the present invention is to provide a weight member for a golf club head, wherein the weight member is made of a WMoNi alloy to improve the uniformity of the shining finishing and the appearance of the weight member.

SUMMARY OF THE INVENTION

To achieve the aforementioned objects, the present invention provides

a weight member for a golf club head that is made of a WMoNi alloy by powder metallurgy or a precision casting process. The WMoNi alloy includes tungsten 1-70 wt%, molybdenum 4-55 wt%, and nickel 25-95 wt%. Molybdenum increases the density pf the weight member and improves the rust-resisting property of the weight member. The tungsten, molybdenum, and nickel provide a uniform metallographic phase. Uniformity of shining finishing of the weight member is thus improved.

Other objects, advantages and novel features of this invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is an exploded perspective view of a golf club head in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention is now to be described hereinafter in detail.

A golf club head in accordance with the present invention includes a golf club head body 20 having a recession 21 and a weight member 10 engaged in the recession 21 of the golf club head body 20 by means of welding, insertion, pressing, or brazing. The shape of the weight member 10

and the location of the recession 21 can be altered according to the product need. The weight member can be made by powder metallurgy.

In a case that the weight member is manufactured by a precision casting process, metals are fed into a high-temperature furnace at a temperature between 1450℃ and 1750℃ (preferably 1660℃-1680℃) in a specific metal melting sequence and a specific composition ratio while controlling the mixture ratio among tungsten, molybdenum, and nickel, thereby forming a molten WMoNi alloy. Next, the molten WMoNi alloy is poured into a preheated mold with a specific shape, precise patterns, and letters. The preheating temperature for the mold is set between 950℃ and 1300℃. Thus, a weight member for a golf club head is made by a precision casting process. The weight member is then engaged (by, e.g., insertion, welding, pressing, etc.) to a golf club head body that is generally made of stainless steel, such as stainless steel of SUS304, 17-4, and 4130.

According to the present invention, in the precision casting process, nickel particles, molybdenum particles, and tungsten particles are added in sequence into the high-temperature furnace. The molten nickel reduces the melting point of the tungsten. Thus, the tungsten particles having a high melting point melt in the furnace without causing sedimentation of tungsten. Next, appropriate sampling test and control are proceeded to form molten

WMoNi alloy comprising tungsten 1-70 wt%, molybdenum of 4-55 wt%, and nickel of 25-95 wt%. Although the density of molybdenum ($10.2g/cm^3$) is smaller than that of tungsten ($19.3g/cm^3$) having a melting point at 3410℃, molybdenum has a lower melting point (2610℃) so that, the furnace temperature required for precision processing is lowered through increasing the amount of molybdenum and reducing the amount of tungsten.

The density of the WMoNi alloy can be changed according to different uses of the golf clubs. Preferably, the density of the WMoNi alloy is between $8.6g/cm^3$ and $16.6g/cm^3$.

In a case that the weight member is manufactured by power metallurgy, tungsten powders of 1-70 wt%, molybdenum powders of 4-55 wt%, and nickel powders of 25-95 wt% are mixed and then pressed and sintered to form the required weight member 10.

In either case, the weight member made of WMoNi alloy contains no iron, and the amount of tungsten in the WMoNi alloy is lower than that in conventional weight members made of WFeNi alloy. Since the WMoNi alloy contains no iron and since the density of molybdenum is greater than iron, the rust-resisting property of molybdenum is better than that of iron. As a result, the weight member 10 would not generate pearlite structure that adversely affects the strength or rust-resisting property. Namely, the weight member in

accordance with the present invention has a greater density and improved rust-resisting property. During spray testing at 40℃ for 24 hours (which simulates a highly corrosive environment) to the WMoNi alloy by using NaCl solution of 5% by weight, it was found that the rusting problem was improved by the WMoNi alloy.

In addition to insertion, pressing, and brazing, the weight member 10 can be engaged to the golf club head body 20 by welding such as tungsten inert gas arc welding, laser welding, or electrical arc welding.

Further, since the tungsten, molybdenum, and nickel provide a uniform metallographic phase, no γ (iron, nickel) phase is generated. Thus, precipitation of tungsten on the surface of the WMoNi alloy is prevented, and undesired patterns would not be generated. Since the surface of the weight member 10 provides improved shining finishing uniformity, the insertion line between the weight member 10 and the golf club head body 20 can hardly be seen when the weight member is directly engaged to (particularly by insertion) the surface of the golf club head body 20 and then polished. Thus, the engaging difference between individual golf club head body 20 and the weight member 10 can be avoided, and the processing conditions can be controlled to be the same. Accordingly, the added value and the engaging/assembling tolerance of the weight member 10 are increased.

Further, the flowability during casting can be improved by means of adding silicon less than 1.5%. Further, an appropriate amount of manganese (Mn), copper (Cu), vanadium (V), and niobium (Nb) can be optionally added. The mechanical properties of the weight member, the flowability during casting, and removal of gas are improved when at least one of Mn of less than 1.0%, Cu of less than 4.0%, V of less than 1.0%, and Nb of less than 1.0% is added. Further, the WFeNi alloy may contain trace elements such as carbon of less than 0.1%, sulfur of less than 0.1%, and phosphorus of less than 0.1%.

According to the above, the disadvantages of the weight member made by the conventional precision casting process are obviated and/or mitigated by the weight member 10 in accordance with the present invention. The physical/chemical properties of the weight member 10 are improved by means of replacing iron with molybdenum. The density of the weight member 10 is increased. Further, the rust-resisting property, uniformity of the shining finishing, appearance, and the assembling tolerance of the weight member are improved while allowing the weight member to be welded to a golf club head body.

While the principles of this invention have been disclosed in connection with its specific embodiment, it should be understood by those skilled in the art that these descriptions are not intended to limit the scope of

the invention, and that any modification and variation without departing the spirit of the invention is intended to be covered by the scope of this invention defined only by the appended claims.